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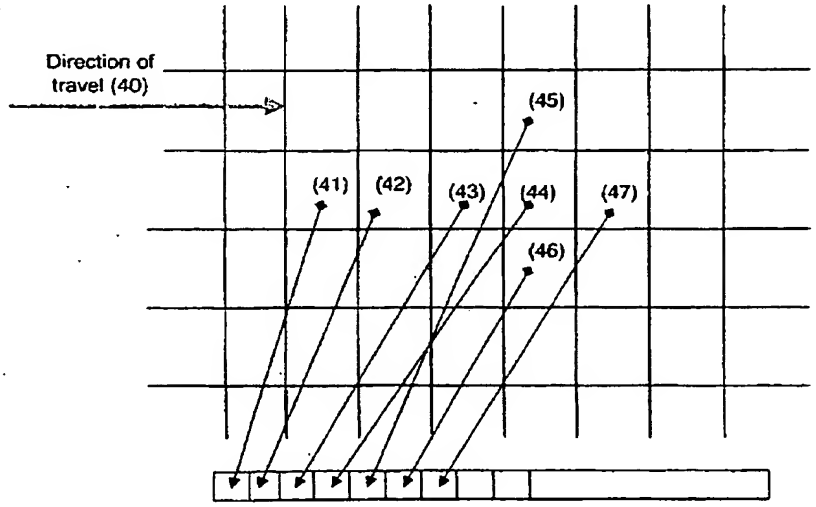
(54) Title: MAP SERVICE



(57) Abstract: The invention relates to a method at a wireless communications system which makes possible that map information can be generated in a service server and transmitted to a mobile client, where the map is gradually built up on a display unit depending on the client's geographical position and movement. A map over a whole district is transmitted in a data stream as separate, small map segments, but with only one call to the service server. The client unpacks the data stream in real time, extracts the map segments and shows them on the display unit as they are arriving. The map database sorts the map segments in a specific order, based on in which order the map segments shall be shown on the client's window. The sorting is based on: the client's position, the client's movement - both direction and speed, the time (RTT) for transmission of a map.

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MAP SERVICE

Technical field

The present invention relates to a method, which, at a wireless communications system, makes possible that map information can be generated in a service server and be transmitted to the display unit at a mobile client or user terminal, where the map gradually is built up depending on the client s geographical position and movement. The map information is transmitted to the client as an amount of separate objects, map segments, in an efficient and bandwidth saving way, and district map is gradually built up on the display unit.

Prior art

It is well known to transmit maps via radio or cable connection. At present there are no known services that make it practically feasible to transmit maps to mobile clients.

Technical problem

Wireless communication always implies that the bandwidth is limited. This is a problem when larger amounts of data shall be transmitted and the bandwidth is small. If information shall be transmitted via mobile telephone networks, such as GSM, this results in problems depending on the limited bandwidth of the media. This has resulted in that maps, which normally include large amounts of data, have not been transmitted via such communication.

At travels, information is often needed about the position, and often also map information for planning of

route. To directly get access to such information while travelling, one is obliged to use mobile communication, often mobile telephony, and consequently transmission of maps is a bottleneck.

Two-way communication means that the client requests a map image, and a map database responds by transmitting an image of a map. This results in an extensive communication with questions and answers for each transmitted map segment, and by that a high load on the transmission media.

At reception of a map the whole map is shown only when the whole image of the map has been transmitted. By that it will take long time before the user will get any information from the map.

Transmission of map segments is made in the order they have been stored in the database. This results in that the client has no possibility to prioritise the transmission to get a quicker access to the map segments of greatest importance or those most up-to-date.

Technical solution

This invention shows how map information is generated in an intelligent way to make it possible to be distributed to a client where the map gradually is built up, adapted to the client's position and movement. The map information is transmitted continuously, efficient and adapted to the client to utilise the limited bandwidth that is available.

From the client the following information is transmitted to the server:

- the client's position

- the district for which map is wanted
- the client's speed vector
- information about which map segments that are stored in the client.

The method implies that a map over a whole district can be transmitted to the client as an amount of separate, small map images, but initiated by only one call to the service server. The vector of objects, i.e. map segments, which has been created by the algorithm in the map database is converted to a data stream, for instance by means of standard functions in the program language Java. Data in the stream then can be condensed by a suitable condensation algorithm, such as zip, and be transmitted to the client.

The client unpacks the stream in real time and extracts the map segments (objects), which are shown as they arrive. By this method is made possible rapid load of map also by TCP/IP over GSM.

By the map being packed in a stream, the client only needs to make one request for each map, but yet can receive the map segments and unpack them and show them on the client's display unit as they are arriving.

By the method, the traditional structure that characterises the traffic on Internet is avoided, with "request-response" for each transmitted object (map segment). This means, in addition to saved time and load in servers, also that the limited bandwidth is not loaded with unnecessary traffic. In order to further maximise the transmission speed of map data, data that are transmitted are condensed.

A technical embodiment of a system for the invention includes terminal/client, a map database and a service node in the form of a server. The terminal contains positioning system (for instance GPS) and data communication functions (possibly mobile).

Advantages

A mathematical model controls in which order the map segments are transmitted to the client equipment. By that, it is easy to change this control mechanism, by changing the mathematical model. The invention in this way can easily be adapted to different needs and possibilities, and also easily follow the technical development and utilise new improved mathematical models.

According to the invention, two-way communication is utilised, so that the client requests that a map segment shall be transmitted, and supplies rules for the transmission in form of information, which controls the mathematical algorithm such as position, speed, direction and RTT (Round Trip Time). After that, transmission of a series of map segments starts. The transmission by that has the character of: "1 request → a lot of response packets".

The client equipment receives and handles the map segments and unpacks them as they are arriving. The map image is in that way gradually built up in the client equipment as map segments are received.

By the two-way communication, the terminal can control which map segments that shall be transmitted. This control is achieved by the terminal transmitting a vector, which contains information about the identity of the segments that are already stored in the client. Map segments that

are already stored in the client equipment need by that not be transmitted again.

The scale of the map can be flexible.

In order to limit transmitted amount of data, a condensation algorithm is utilised. The condensation algorithm is exchangeable - any condensation can be used.

The invention includes several means to make possible fast transmission of map images on a medium with limited bandwidth:

- The client can control which map segments that shall be transmitted, and in which order they shall be transmitted.
- The map segments are unpacked as they are arriving to the client, so that the map image is growing on the display unit of the client equipment.
- One request for transmission results in transmission of a lot of map segments.
- The scale of the transmitted segments can be adjusted to optimally utilise bandwidth, and at the same time give the user the information that is required.

A solution according to the invention is technically easy to handle since:

- Only standard components are needed for the user equipment (GPS-receiver or receiver for other positioning system, ordinary computer, and access possibility to Internet or a corresponding computer network via, for instance, GSM).

- The service is easy to use - load a program and the service is accessible.

- All included units communicate via an open computer network such as Internet by a universally accessible protocol such as TCP/IP, which makes it easy to distribute the system.

- By the utilisation of an open computer network it is easy to rescale the system for fewer or more users, and to extend the system with different geographical districts as market and need are changed.

- Operation, maintenance and further development of the service is facilitated by upgrading/updating and other changes only needing to be made in one place.

List of figures

Figure 1 shows the whole map image that is in the map database, and the cut district, for which the client has requested a map.

Figure 2 shows how the cutting of the requested disrict is divided into objects, map segments.

Figure 3 shows sorting of map segments that are transmitted to the client if the user is walking or moving slowly.

Figure 4 shows sorting of map segments that are transmitted to the client if the user is moving with higher speed, for instance travelling by car.

Explanation of terms

GPS Global Positioning System.

GSM Global System for Mobile Communication. Cellular mobile telephone system.

RTT Round Trip Time. The time from that a request has been transmitted to the service logic, until its wanted information has been received.

IP Internet Protocol. Protocol that is used in Internet.

TCP Transport Communication Protocol.

ISP Internet Service Provider. Internet provider.

DETAILED DESCRIPTION

The description below refers to the figures in the enclosed drawings.

Structure

The present invention describes the information service, suitably built up as a client/server solution. The invention can constitute a map support directly adapted to the user's utilisation, or constitute a part of an information service where a service provider, for instance an ISP, offers a service where map information is a part. To each service server a multiple of clients can be connected, which makes the system scalable. The clients are connected to the service server and all communication is

passing via this service server, which in its turn is connected to a map database.

The client's position, which is needed for showing the right district map to the user, is obtained by means of a positioning system, for instance GPS, but the position can alternatively be entered manually.

All communication can be executed by means of TCP/IP, which is used on Internet. This means that the parts need not be on the same physical place, and that it is easy to connect a client to the service server.

Transmission of map

According to the invention, a map is transmitted of a whole district as separate, small map segments, but by only one call to the service server. The vector of objects, i.e. map segments, which is created by the algorithm in the map database, is converted into a "data stream" by means of standard functions in the program language Java. Data in the stream are condensed by means of a suitable algorithm (for instance zip) and the condensed stream is then transmitted over TCP/IP to the client.

The client unpacks the stream in real time and extracts the objects (map segments) and shows them on the display as they are arriving. By this method fast loading of map is made possible also by TCP/IP over GSM.

By the map being packed in a data stream, the client only need to make one request for each map, but yet can receive a suit of map segments.

The terminal transmits, at request for transmission of map, en vector that informs about which segments that are

already stored in the client. This vector contains the identity of stored map segments.

By the two-way communication, the terminal in this way can control which map segments that shall be transmitted. Map segments that are already stored in the client equipment by that need not to be transmitted again.

Map database

The map database contains a number of large images over larger districts (11) such as Stockholm, Luleå, Gotland etc. In the map database, which can be for instance bitmapped maps or vector based maps, is analysed which district the client wants, and the whole map image, which contains the district of which the client has requested a map, is derived. From this whole map image the map district (12) that corresponds to the district the client has requested is cut, see Figure 1.

The map database divides the cutting in objects (i.e. map segments) comprising for instance 100*100 pixels at bitmapped maps. See Figure 2.

The map database sorts the objects (map segments) in a specific order, based on in which order the map segments shall be shown on the client's window. The sorting is primarily based on:

- the client's position,
- the client's movement, both direction and speed,
- RTT, (Round Trip Time), i.e. the time it will take from that the client has requested a map, until the map has arrived at the client.

Normally, the map segment where the client is, is sorted as first object. After that, the objects are arranged in an order so that the map segments build up the whole requested map district round the user. This sorting method is used if the client has low speed, for instance if it is used by a walking person, see Figure 3. Map segment 31 in Figure 3 contains the client's position.

If the user is moving fast, the objects (map segments) can be sorted in an order that is controlled by the client's speed (incl. direction). If the client is used in a car, the map segments are sorted so that they are unpacked in the direction of travel first, and after that are other map segments shown on the client's screen, see Figure 4. Map segment 41 in Figure 4 contained the client's position at request for transmission of the map.

The objects (i.e. the map segments) are put together in wanted order in a vector that contains all map segments. The vector is then transmitted to the client, where the map is built up, bit by bit, in the order that is wanted. The map is tailored and adapted to the conditions that apply to the client.

According to the invention, the map image is built up gradually on the display unit of the user's terminal in best way with regard to the user's position, speed, direction and round-trip-time.

Client application

The user is equipped with a terminal (client computer, for instance an ordinary, portable computer) with functionality for positioning (for instance GPS), operative system, as well as access to Internet, for instance via a telephone, preferably mobile telephone, for instance GSM.

Necessary software for the positioning system shall be in operation at the client computer. The software can easily be taken into operation for instance by loading via Internet from the service provider's website and subsequent installation.

The user sets up a fixed or dynamic connection to Internet by his/her Internet-provider. The client software reads the position from the GPS-receiver and transmits the position to the service server for map management, which derives the right map image from the map database in suitable picture coding format, for instance GIF-format, and transmits it to the client. The client software continuously indicates the user's position on the map, for instance 1 time/second.

When the user is approaching the edge of the map image, the client transmits a new corrected position to the service server, which sends the next map image, on which the user's position then is indicated.

All map segments that have been received in the client are stored locally until the program is finished, or the allocated space for maps is full. Request for transmission of map contains a vector with information about which map segments that are stored in the client. Transmission of the map segments that are already stored locally then will be suppressed. By this procedure, deriving of map is essentially accelerated if the user returns into a previously visited district.

The client transmits requests to the service server containing important parameters to make possible correct delivery and optimisation of transmission of map images. In request for transmission of map is included: Position, speed, direction, RTT (Round-Trip-Time), size of map, and

information about which map segments that are stored in the client's memory. New request for map and information objects are transmitted when the user is approaching the edge of the already loaded map.

Exactly when a request is transmitted is decided by the client by means of RTT combined with speed and direction. In this way the client can pro-actively make requests to secure that map and other information is loaded in time for a district the client is on his/her way into.

The user can manage parts of his/her personal profile directly via the client application, which is then transmitted and stored in the service logic. The advantage of this, instead of storing the profile locally, is that the user can use just any mobile terminal with the client program installed and yet have access to his/her personal profile.

Scenarios

As traveller in foreign places one often needs a map to find the place to which one wants to go. The traveller will have an up-to-date map of the district where he/she is.

When at sea it is safe to have a good and up-to-date nautical chart over the zone where one is sailing. If the map database is utilised, the seafarer never need to ponder about whether the nautical chart is old or not.

A haulage contractor can get the commission to deliver goods to different places where it can be difficult to find one´s way even with good knowledge of the locality. I can be worth a lot to, in a simple way, show the customer's address and description of route in form of access to a

map. To the haulage contractor it is a question of delivering the goods quickly, and then it is important to have access to a map that is up-to-date. It is also of great value always to have a map available at transports to different places.

Because the map image can be updated continuously, it is possible that police and the authority that is responsible for the road also utilises this means to distribute acute information about road conditions, closed roads, or other conditions that influence accessibility and risks. This can be of special value in connection with heavy transports in districts where the road conditions can vary, for instance during the breaking up of the frost in the ground.

ALTERNATIVE EMBODIMENTS

The invention is not limited to the above described embodiments, but can, in addition to that, be subject to modifications within the frame of the following patent claims and the idea of invention.

Adaptation

The downloading of the map can be controlled by shown route, selected route, and changes in selected route by adaptive selection of map segment and of scale. The algorithm for priority at transmission of map segment then will take into consideration the route the traveller has selected, or the route according to the map image that is in the map database. By that, the client's future changes of direction can be taken into consideration. Map segments can also be transmitted to the client for a planned route.

Intelligent agents, which have possibility to predict the user's actions, can, by supplying input data to the algorithm for priority at transmission of map segments, in different ways prepare, facilitate and improve transmission of map segments.

The unpacking of the received packets in the client equipment is made as the packets are received. The packets consequently are unpacked each, before the whole sequence of map segments has been received. In that way the image will gradually be built up in the client equipment. With a good algorithm, the user will see a map image gradually appear on the display unit in such a way that the districts that are most important will be shown first. At travel by car, for instance, map segments in the direction of travel will be shown first, see Figure 4.

Flexible scale

The presentation/showing on the client can be independent of transmitted scale, so that map segments that have been transmitted in small scale are enlarged. The content of details will be lower in map segments that have been transmitted in a small scale, but on the other hand, the transmission will be faster, so that the user quickly will have an overview.

Different scales, or levels of detailed presentation, can be used in the database for different parts of the map, depending on need of level of detailed presentation.

Transmitted map segments can be transmitted with different scales or levels of detailed presentation, so that closely located map segments show a larger amount of details than map segments that are farther away.

The scale of the map can be flexible, so that the user can get an overview over a larger district, at the same time as he/she can see details in the neighbourhood of position of current interest.

The user can request different scales for different parts, depending on need.

The scale can be related to available transmission capacity and speed. At poor transmission capacity, or at rapid movement, the level of detailed presentation can be reduced.

Alternative positioning

The user can request showing of a map over another district than where he/she is. By providing position information, the user can get a map image for, for instance, planning of a journey.

Infrastructure and alternatives

Other computer networks than Internet can be utilised and the communication of the terminal can pass via GSM or other communication network.

The positioning/position indication can be made by GPS, other positioning system, or by manual position indication.

The invention is applicable to both vector maps and bitmapped maps, or maps that are utilising other technology.

PATENT CLAIMS

1. A method to, at request from a client, transmit map information from a service server to a display unit at said client via a communications system, at which the map information is generated in said service server and transmitted via said communications system to said display unit depending on an indicated geographical position, c h a r a c t e r i s e d in that said map information consists of a district map, which is transmitted to the client as an amount of separate objects, map segments, at which said district map is gradually built up on said display unit.

2. A method as claimed in patent claim 1, c h a r a c t e r i s e d in that the transmission is made by means of utilisation of a universally accessible protocol, for instance the TCP/IP-protocol and via two-way communication, for instance in an open computer network such as Internet, and that the client communicates via mobile or fixed communication.

3. A method as claimed in patent claim 1 or 2, c h a r a c t e r i s e d in that said amount of separate map segments are converted into a data stream, for instance by means of standard functions in the program language Java, and that data in the data stream are condensed by means of a condensation algorithm, for instance zip.

4. A method as claimed in any of the previous patent claims, c h a r a c t e r i s e d in that said transmission of district map is initiated by only one call to said service server.

5. A method as claimed in any of the previous patent claims, c h a r a c t e r i s e d in that said indicated geographical position is the client's position, and that the client's position is entered manually, or decided by a positioning system, for instance GPS.

6. A method as claimed in any of the previous patent claims, c h a r a c t e r i s e d in that the order in which the map segments are transmitted to the client is optimised by a mathematical model, and that said mathematical model is exchangeable.

7. A method as claimed in patent claim 6, c h a r a c t e r i s e d in that said optimisation of the order in which the map segments are transmitted to the client equipment is based on information that are transmitted to the service server from client, such as said indicated position, the district for which map is wanted, the client's speed and direction, and the time from that said request has been transmitted to the service logic, until wanted information has arrived.

8. A method as claimed in patent claim 6 or 7, c h a r a c t e r i s e d in that said mathematical model arranges the segments in said transmission of district map with regard to route, according to the map image that is in the map database, the route the traveller has selected, and changes in selected route.

9. A method as claimed in any of patent claims 6 to 8, c h a r a c t e r i s e d in that intelligent agents create input data to said mathematical model by predicting the user's need and behaviour.

10. A method as claimed in any of patent claims 6 to 9, c h a r a c t e r i s e d in that the client transmits a new, corrected request for transmission of map information to the service server if the client's speed or direction is changed, and when the user is approaching the limit of the geographical district that is covered by said district map, at which the service server starts transmitting a new district map and that point of time for transmission of said corrected position is decided by means of the client's speed, direction and the time from that a request has been transmitted to the service logic, until wanted information can be shown on said display unit.

11. A method as claimed in any of the previous patent claims, c h a r a c t e r i s e d in that the client receives, handles, unpacks and shows the map segments as they are arriving, so that said district map is gradually built up in said display unit, and that this unpacking and showing starts during said transmission of map segments.

12. A method as claimed in any of the previous patent claims, c h a r a c t e r i s e d in that all map segments, which have been received in the client, are stored locally in the client until the program is finished, or the allocated space for maps is full, that said request for transmission of district map includes a vector with information about which map segments that are stored in the client, and that transmission of the map segments that already are locally stored, is suppressed.

13. A method as claimed in any of the previous patent claims, c h a r a c t e r i s e d in that

- map segments, which have been transmitted in small scale, are enlarged at showing on the display unit of the client equipment

- different parts of the map is stored in the map database with the same, or different, level of detailed presentation

- map segments are transmitted in different scales, or with different levels of detailed presentation, so that closely located or important map segments have a more abundance of details than map segments of less importance.

- scale, or level of detailed presentation, is related to speed and supply of transmission capacity so that, for instance, fewer details are shown if the client's speed is high.

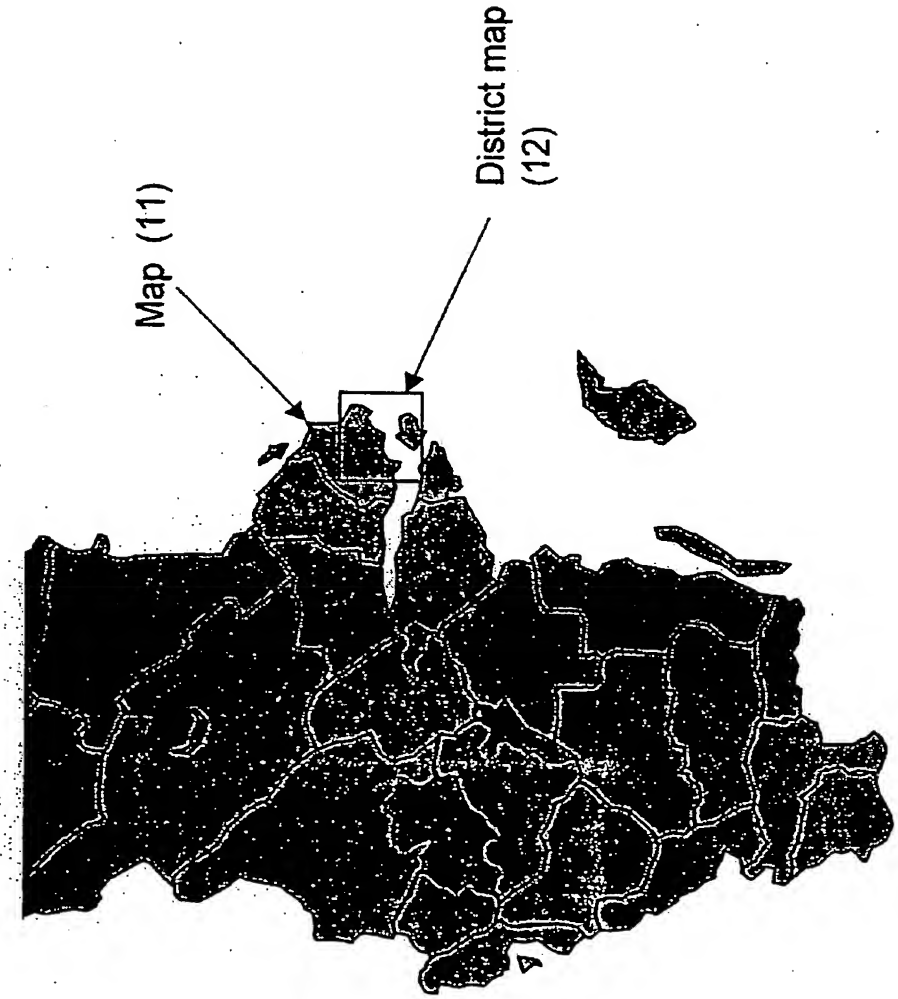

Figure 1

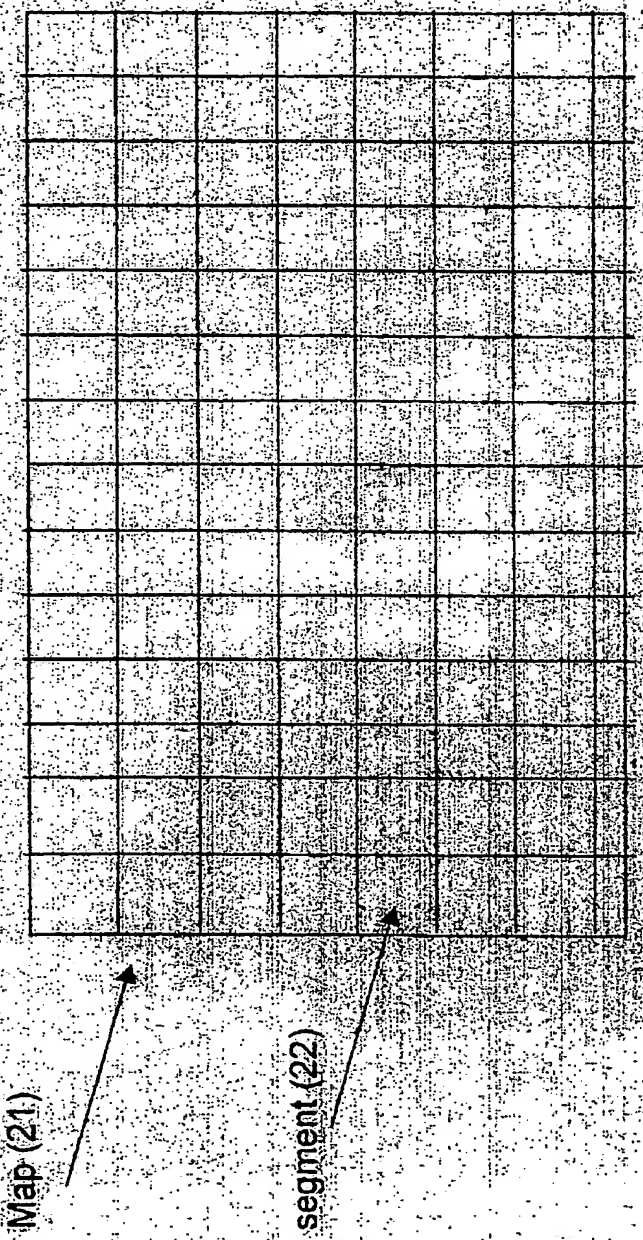

Figure 2

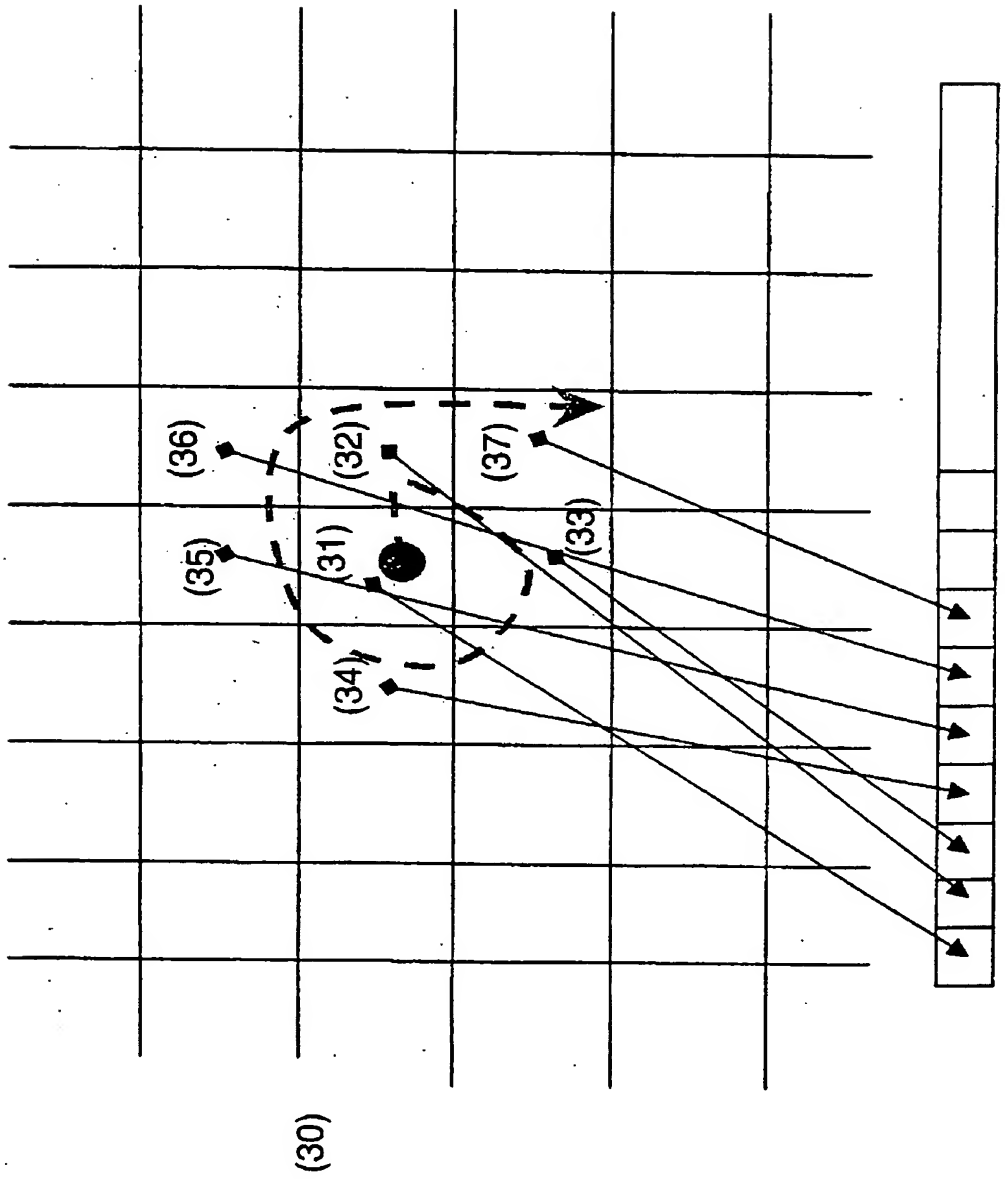

Figure 3

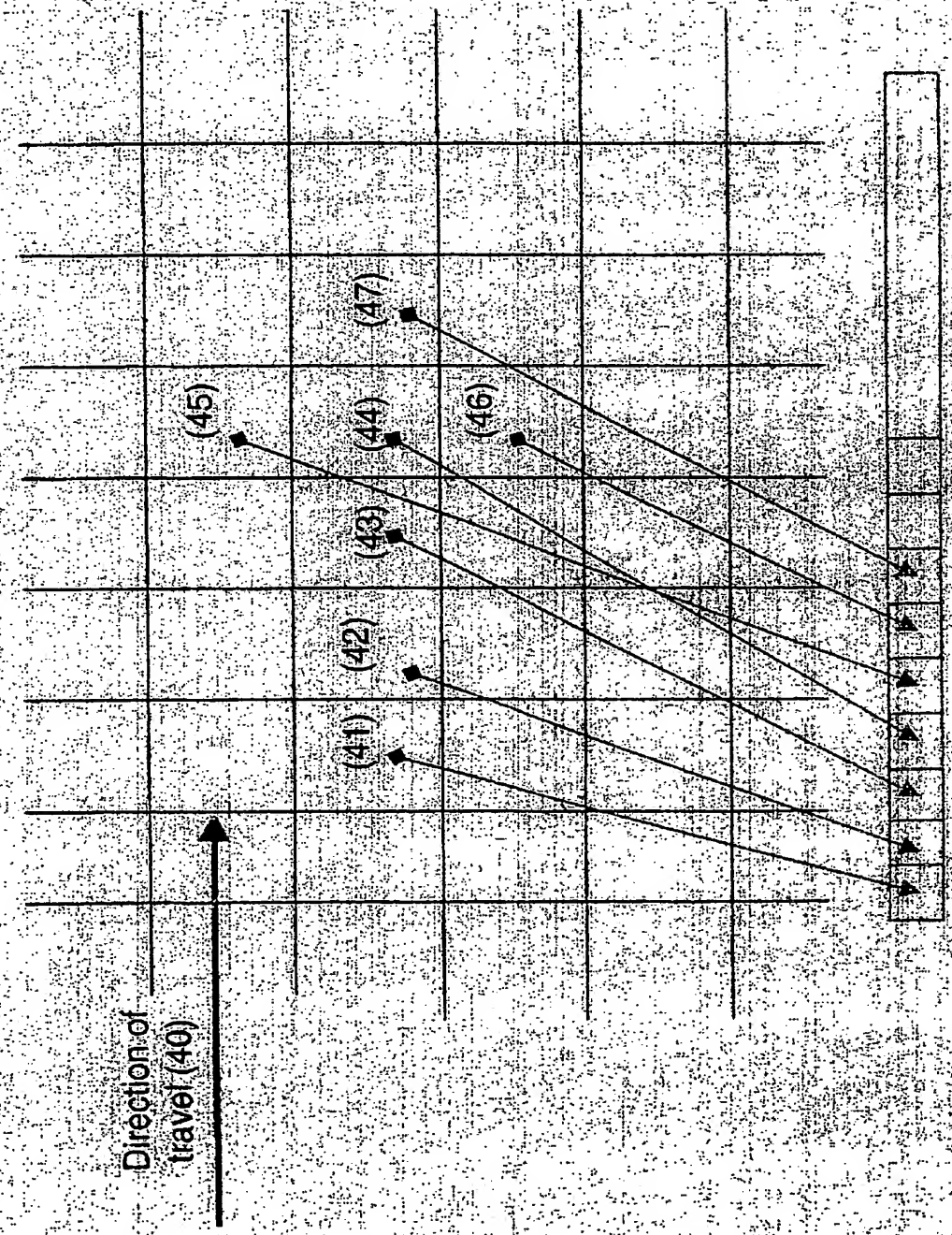

Figure 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01338

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: G08G 1/0969, G01C 21/20
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G01C, G06F, G08G, G09B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	EP 0838663 A2 (NAVIGATION TECHNOLOGIES CORPORATION), 29 April 1998 (29.04.98), page 3, line 2 - line 5; page 3, line 27 - line 44	1-13
P,A	EP 0933616 A1 (RENAULT), 4 August 1999 (04.08.99), claims 1-4, abstract	1-13

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 Sept 2000	11-10-2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM	Authorized officer Peter Gönansson/ELY

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01338

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/SE 00/01338

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